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INFORMATION PAPER

SUBJECT: Information Paper regarding the history and importance of Army Warfighter Outcomes (WFOs).

1. **Purpose.** Provide the purpose, relevance, and some background on the origin of the WFOs.

2. **Facts.**

a. Army Warfighter Outcomes are used to guide and shape the Army's S&T investment. All Army funded 6.2 or 6.3 efforts are linked to specific WFOs. They directly shape Technology Enabled Capability Demonstrations, Joint Capability Technology Demonstrations, Small Business Innovation Research Phase I and II efforts, and articulate the Warfighter's most challenging technology needs to industry and academia.

b. In November of 2007, the SecArmy (Honorable Mr. Geren) directed HQDA Staff (G-3/5/7, & G-8), ASA(ALT) (DASA-RT), and TRADOC/ARCIC to establish a single point of focus which express the Science and Technology needs of the Warfighter. The result of that tasking was the creation of the Army Warfighter Outcomes.

c. In Aug 08 the Army Chief Scientist (Dr. Killion) brought the first WFO list to the CSA for his approval. Every year since, WFOs have been developed and approved at ARCIC and are confirmed by the TRADOC Commander. This makes them the Army's approved authoritative source for the Warfighter S&T needs.

d. Attached is the Publicly Releasable WFOs .

Mr. Meneghini/ATFC-ET/5166
APPROVED BY _____

FY 12 Army Warfighter Outcomes

Tier 1 - BIG Five Warfighter Outcomes

(T-1) Training - Provide Soldiers and leaders the ability to excel in a challenging and increasingly complex future operating environment by developing tools and technologies that enable more effective and efficient training through live, virtual, immersive, mobile, and adaptable venues. Future training must enable individuals and units to become proficient at more skills, faster, at a lower cost, and with greater retention than currently achievable. Training in units requires enhanced training techniques and technology for on-demand mission rehearsal, individual/collective/battle staff training, and training prior to new equipment availability. Future learning technologies / methods must enhance and account for individual differences and experience levels. Future training must be completely adaptable and scalable to cover the full spectrum of operational challenges facing the Soldier.

(MC-1) Mission Command - Mission command is the exercise of authority and direction by the commander using mission orders to enable disciplined initiative within the commander's intent to empower agile and adaptive leaders in the conduct of full spectrum operations. It is commander-led and blends the art of command and the science of control to integrate the warfighting functions to accomplish the mission. Mission command capitalizes on mutual trust and initiative to empower subordinate leaders operating decentralized with the combined arms capabilities, competency, and authority to achieve tactical, operational, and strategic advantage. To realize this, the Future Force must possess worldwide, beyond-line-of-sight network capabilities that are effective, layered, and protected. This network must integrate mission command for unified actions with a single, integrated universal tactical network accessible to the global information grid. It must be optimized for air and ground mobile operations and increase required throughput to the individual Soldier through dynamic, extended range, self-organizing and multilayered communications with decision and planning support capabilities. Additionally, units must execute inform and influence activities and win the cyber/electromagnetic contest via the seizing, retaining, and exploiting advantages in cyber and the electromagnetic spectrum.

(S-PE-1) Power & Energy - Enhance ground force effectiveness, freedom of movement, flexibility, endurance, resilience and protection by reducing the need to resupply fuel and batteries, improving utility and utilization of energy resources in the face of dynamic operational situations. Dramatically reduce sustainment footprint, lighten soldier load and extend platform range/self-power endurance by combining component functions, increasing interoperability, improving energy efficiencies and storage densities, and integrating power management functions. Expand capabilities to utilize alternative energy sources, recycle energy, water and waste, and to redistribute resources among systems. Reduce number of Soldiers and systems required in forward areas by deploying multi-function and unmanned systems, and expanding reach capabilities. Integrate power & energy management functions with Mission

Command to optimize energy use and enable situational awareness and to integrate energy considerations into operational planning and decision processes.

(CIED-P-1) Counter IED and Mine - The Future Force must have the ability to detect, classify and neutralize Explosive Hazards (IED, mines, booby traps and UXO) and/or their components from a sufficient standoff distance. Included in this is the need to detect, classify and neutralize CBRN threats and explosive hazards. The Future Force requires the capability to locate the hazard, determine the type of hazard, select the best method of neutralization, and ascertain the potential effects on the environment. This capability will allow the commander to assure mobility while protecting Soldiers and platforms from the effects of these threats and hazards.

(HD-1) Human Dimension - The Future Force requires adaptable resilient Soldiers to achieve the Army Operating Concept's goal of *operational adaptability* in a dynamic, uncertain and demanding future operating environment. The Army must accurately identify attributes, inherent talent and potential to improve recruiting, MOS alignment, training, education and development of Soldiers committed to service, competent in individual and collective tasks and imbued with Warrior Spirit and Army values. This requires a concerted multidiscipline, coordinated enterprise-like effort to develop cognitive, physical and social capabilities throughout the Soldier lifecycle of service and transition to civilian community.

Tier 2 - FY 12 Army Warfighter Outcomes

Directly Supporting Big 5 Warfighter Outcomes or S&T 'Big Issues'

(T-2) Realistic, Integrated and Mission Command-centric Training Environment -

The Future Force requires an embedded, networked, and integrated training environment (ITE) at homestation, combat training centers, and deployed. An integrated training support network and enablers are required to support realistic training and education for full spectrum, unified action operations, and sustainment/maneuver support challenges associated with decentralized and distributed operations, mission command networks, and sensors. Mission-command-centric training capabilities must replicate complex operational environments with a level of realism sufficient to optimize training effectiveness for full spectrum operations (FSO) METL training. Unit leaders must have the ability to conduct on-demand distributed training and mission rehearsal across echelons and geographical locations. Using live, virtual, constructive, and gaming (LVC&G) training environments, unit leaders require the capability to "dial up" and "dial down" intensity, dynamic change, and rigor in training exercises. Unit leaders must be able to quickly and affordably develop and implement complex training scenarios and conduct individual and collective training without significant external support.

(MC-2) Create Common Situational Understanding - The Future Force requires the capability to enable collaboration to facilitate common situational understanding and interactive adaptability vertically and horizontally across the force to support full spectrum operations in a unified action operational environment. The backdrop for understanding common situation begins with the ability to collect, generate, fuse and disseminate high-resolution geospatial data across the network. This requires standard and shareable geospatial data that supports all six warfighting functions. Geospatial data must be customized to a unit's mission in a unified action and operational environment. It includes geospatial data, products, information, applications, tools, displays, etc.

(S-2) Force Health Protection Initiative - The Future Force requires a capability to provide advanced medical treatment from the point of injury across the entire continuum of care, including medical evacuation, through the application of remote technologies and care providers in a joint inter-dependent trauma system while conducting FSO in a joint, interagency, intergovernmental, and multinational environment.

(a) The Future Force requires a First Responder capability to control non-compressible bleeding, provide blood component therapy and specialized far forward trauma care for damage control resuscitation of pre-surgical patients, as well as, the ability to rapidly assess the existence and severity of head trauma.

(b) The Future Force requires a capability for safe and effective pain management at all levels of care and a capability to fully restore, reconstruct, and rehabilitate wounded warriors to ensure effective return-to-duty with appropriate standards, particularly following psychological and traumatic brain injuries.

(c) The Future Force requires protection against infectious diseases via portable and flexible remote sensing and detection systems which will permit rapid characterization of pathogens as well as accelerated development of vaccines and medications to prevent illness.

(d) The future medical force requires the capability to capture, process, and disseminate real-time medical information on the Soldier's physiological status, injuries, illnesses, wounds, and treatment provided from the point of injury through definitive care. This provides the commander a greater awareness of Soldier status and provides the Soldier with a complete digital medical record.

(P-2) Combat Identification – The Future Force requires the capability to identify friend, enemy, neutral and noncombatant during full-spectrum operations to prevent fratricide and protect populations.

(HD-2) Assessment, Readiness and Resiliency - The Army requires Soldiers able to endure the physical, mental and environmental stresses of future full spectrum operations. Advances in neuroscience and related behavioral sciences show promise in improving mental strength and developing predictive, preventative and remedial means. Scientific breakthroughs in biochemistry and brain functioning may enable identification of both vulnerable and resilient traits in individual Soldiers. These predictive indicators will inform specific training and education necessary to develop appropriate TTPs and/or procedures to protect and strength Soldier vulnerabilities. New initiatives may provide means to develop mental and psychological strength similar to physical training developing muscular strength and endurance. Neurological and biochemistry developments will provide monitoring and assessment tools to Supervisors of Soldier readiness to perform stressful tasks or combat operations. The Army must include the transitioning healthy confidant Soldiers to the civilian community and Veterans Administration when military service is ending.

(Int-4) Data-to-Decision (Processing, Exploitation and Dissemination) - The Future Force requires the capability to sufficiently manage the processing and exploitation of collected data and provide support to commanders' situational awareness and situational understanding and the common operational picture (COP). This capability includes automated information synthesis to tag, process, and transform data rapidly and accurately into usable knowledge, across a wide range of subjects from military logistics to culture and economics.

(T-3) Adaptive Training System (Developing Means to Effectively and Efficiently Capture Warfighting Experience/Knowledge and Incorporate it in Institutional, Unit and Self-development Training and Education) - The Future Force requires responsive training development methodologies, infrastructure, and applications that rapidly and effectively incorporate emerging warfighting experience/knowledge into institutional, unit and self-development training and education. The Future Force requires automated training development tools, collaborative development environments, and shared information repositories to rapidly and efficiently capture,

incorporate, and disseminate relevant information through effective learning modules and scenarios at the point of need.

(MC-3) Mission Command On-the-Move - The Future Force requires the capability to provide commanders the ability to maintain situational understanding while moving in the air and on the ground in a unified action operational environment to synchronize action and maintain the initiative. This includes the capability to employ command posts that are configurable to the commander's unique mission and operating environment and capable of integrating unified action partner resources to enable decentralized full spectrum operations. It has three components:

- (a) A highly mobile (quick set-up and rapid displacement), scalable command post (CP) capability;
- (b) A platform (air and ground) based capability that allows commanders the ability to monitor the COP and thus maintain situational awareness and communications while away from the CP and moving on the ground or in the air;
- (c) An Enroute Mission Planning and Rehearsal capability that provides commanders and staffs the ability to execute mission command while deploying in support of expeditionary and forced entry operations.

(PE-S-3) Power and Energy Management, Optimization, and Efficiency - The Future Force requires a system architecture that relates operational functions and metrics to requirements, systems taxonomies, component technologies and performance.

- (a) The Future Force requires the ability to model and design energy, waste and water systems, in order to analyze existing and prospective systems and their cost/performance impacts to full-spectrum operations. This requires systems and engineering analysis to develop the logical relationships and quantitative performance factors.
- (b) The Future Force requires situational awareness and the ability to manage energy resources and use in the context of expeditionary operations. The goal is scalable, embedded power- management, supported by materials, techniques, and software to manage potential power sources, to reduce demand, to balance load, and to improve efficiencies.
- (c) The Future Force requires flexibility and resilience enabled by energy devices. This requires development of standards, protocols and engineered interfaces to enable scalable networking of sources and applications.

(CIED-P-3) Hazard Detection On-the-Move - The Future Force requires the capability to detect explosive hazards at standoff ranges and speeds. Enable Soldiers conducting area/route clearance to avoid kill zones by detecting explosive hazards at greater standoff and operating speeds.

(HD-3) Soldier Load (MOS Performance Standards) - The Army must devise means to monitor and ameliorate Soldier cognitive, physical and social loading to avoid task saturation, exhaustion, and excessive stress. Provide leaders with assessment tools that enable tracking overall comprehensive fitness. The Future Force requires that

Soldier capabilities meet or exceed the expected cognitive and physical performance requirements by MOS and/or mission type. MOS and/or mission type should be studied to identify core and specific skill/physical requirements Soldiers will need to perform. Attention is required to examine the cognitive load a Soldier is expected to bear to perform via all data inputs provided to mounted and dismounted Soldiers. Every effort must be made to consolidate Soldier systems, data flow, battery types, etc to lighten the physical burden Soldiers bear performing FSOs. This requires counterbalancing capabilities and scientific tools to assess Soldier capacity, align individuals with compatible specialties to meet their optimal load bearing capabilities, align physical fitness requirements and develop, multipurpose kits tailored to the mission, survivability, power generation, environment, and related factors.

(T-4) Contemporary Leader Skills - Future Force leaders will require new methodologies and technologies to rapidly and more effectively develop leaders who can operate with mission command systems, under rapidly changing operational conditions, and confronting a wide variety of threats or crisis scenarios. Future leaders must possess core leader doctrinal, technical, cognitive, and influence competencies to include full-spectrum operations, a Joint, interagency, intergovernmental, multinational (JIIM) and expeditionary mindset, accept change and consequence management as routine conditions, and become proficient in a wide range of new information and mission command technologies. Leaders need multisensory simulators / simulations that fully represent the physical aspects of the operational environment as well as autonomous computer-generated forces that can act, react, and counter react to verbal and nonverbal stimuli to develop doctrinal, technical, and cognitive abilities. Future leaders must be able to improve adaptability and innovation by training against adaptive, Opposing Forces in a realistic Operational Environment, to include role players and indigenous populations in all training environments and domains.

(MC-4) Network the Force - The Future Force requires the capability to provide timely flow of information in accordance with the commander's priorities with integrated, protected, layered, and secure communications capable of both line-of-sight and beyond-line-of-sight to enable unity of command within a unified action operational environment in decentralized full spectrum operations, and permits continuation of operations in a degraded environment.

(PE-S-4) Alternative Energy Sources - The Future Force requires capabilities to utilize an expanded suite of alternative energy sources that supplement or replace current logistic approaches to fuel, water and waste, and offer significantly improved system efficiencies and operational effectiveness.

(CIED-P-4) Identify and Prevent Explosive (IED & Mines) and CBRN (CWA/NTA/ Selected TIM) Emplacement Activities - The current and Future Force requires the capability to disrupt activity prior to emplacement of identified threats.

(Int-3) Precision Collection - The Future Force requires the capability to collect information and intelligence to provide commanders situational awareness and

situational understanding. Capability to effectively collect with precision to detect, identify, track, and locate units, structures, personnel, communications devices, weapons, improvised explosive device precursors, and munitions. This requirement includes the capability to collect against emerging technologies and signatures and to provide for persistent area assessment, situation development, and mission overwatch. It also includes the capability to detect, identify, track, and provide precision location data for units, structures, individuals, communications devices, weapons, improvised explosive device precursors and munitions.

(HD-4) Human Resource Readiness Tools (HRRT) - Future Force commanders require a Soldier Readiness (SR) capability to support training and mission planning. It requires access to multiple data interfaces to present qualified status of a Soldier's cognitive, physical and social status. The SR tool should provide measures of cognitive load, stress, fatigue, profile status on items such as training, language skills, promotion eligibility, emergency data and anything pertinent to individual well being as well as tracking special skills/attributes of the Soldier. This data requires collation and automation to provide alerts, render unit-level assessments and selection ability without overwhelming with volume and detail.

(T-5) Tailored / Adaptable Learning and Training (including Intelligent Tutor) - The Future Force requires training, education, and mission rehearsal capabilities that can be tailored to the specific skills and knowledge level or needs of the individual Soldier, leader, or unit and rapidly developed, updated, and easily accessed. This includes an affordable capability to develop technology-delivered instruction by adapting and tailoring individualized learning to the learner's prior knowledge and learning style preferences.

(MC-5) Enable Unified Action Partner Collaboration - Enable Unified Action Partner Collaboration - The Future Force requires the capability to sanitize, disseminate, share, and exchange information across all Army echelons and with unified action partners to enable collaboration and unity of effort. The term "unified action partners" includes joint, coalition, allied, interagency, and intergovernmental partners.

(PE-MMvr-G-1) Compact Power for Dismounted Soldiers – Enables Soldiers in Small Combat Teams. The Future Force requires the ability to provide Soldiers scalable solutions of sufficient power in a small, lightweight, conformable package. Require capability to rapidly refuel/recharge without disrupting operational tempo.

(CIED-P-5) The Ability From Standoff Range to Identify, Prevent And Mitigate CBRN and Explosive Hazards (IEDs, UXOs, Mines) - The Future Force must have the ability to detect, diagnose, render safe or neutralize CBRN and explosive hazards (IEDs, UXOs, mines) and their components (fillers and firing circuits) from a safe standoff distance. They need the capability to determine the type of hazard, select the best method to render safe and/or neutralize, and ascertain the potential effects on the environment and operations. This capability will allow the commander to maintain maneuver force momentum while protecting Soldiers and platforms from the effects of

these hazards. To be able to detect CBRN and explosive hazards from a standoff range, in order to identify and characterize fillers and firing circuits, to conduct render safe procedures.

(HD-5) Mapping Personnel to Mission Requirements - The Future Force requires the capability to assess Soldiers' wide range of talent, skills, and potential and match them to appropriate MOS or mission type. This assessment capability must be continuous throughout a Soldier's career life cycle to manage leader development efforts, advancement, inform the SR tool and adjust to changing operational demands of the force. Assessment mapping capability enables early skill identification, tracking, development and improved assignment actions especially for highly specialized skills or competencies such as foreign language proficiency and intercultural adaptability. Direct accession of certain skilled individuals (as the Army does with some medical personnel) will reduce maturation time, training and education costs. This requires a careful examination be given to basic Soldier skills and values.

(T-6) Dismounted Soldier Virtual Training Environment - The Future Force requires an immersive dismounted virtual training system that provides sufficient realism to maximize learning transfer. Also provides the ability to participate in the Army Integrated Training Environment (Army ITE).

(MC-6) Create, Communicate, and Rehearse Orders - The future force requires the collaborative capability to create, change, rehearse, disseminate, and distribute mission orders verbally, orally, and graphically between command posts, air and ground platforms, and dismounted leaders and Soldiers to seize the initiative in complex and uncertain environments as part of unified action. This includes the ability to communicate commander's intent, operational purpose, and desired end state; collaboratively create orders, analyze various courses of action using simulations; and rehearse proposed plans in a virtual environment and facilitate Design.

(CIED-P-6) Standoff Detection of Explosive Pre-Cursors - The Future Force needs intrusive and non-intrusive stand-off screening, detection and identification of homemade explosives, explosive pre-cursor components and devices to protect the force and acquire information to attack the network.

(HD-6) Operational Adaptability and Decision-making - The Future Force requires adaptable and resilient Soldiers comfortable with the uncertainty and ambiguity of the future operating environment. The Army requires a comprehensive approach to develop cognitive, physical and social skills, knowledge and attributes conducive to creative and critical thinking. All forms of training require multi-faceted multilayers embedded with Army values, tough moral decision-making, etc., at a minimum to reach the operational adaptability required. This capability is inherent to the concept of Mission Command.

(T-7) Virtual Humans - The Future Force requires high-fidelity, believable, computer-generated virtual humans who can act and react to learners in virtual and live training

and education environments. Virtual humans have appropriate facial expressions and gestures, react and counter-react to verbal and non-verbal stimuli, and act autonomously in the virtual and live environments to support pedagogical learning objectives. Developing affordable, realistic virtual humans to populate large-scale simulations and participate in augmented reality training events expands the range of on-demand, interactive training opportunities and reduces human support overhead.

(MC-7) Training Support for Operational Staff Processes - The Future Force requires the capability to provide mobile, integrated, interoperable, and embedded reconfigurable training tools and simulations in a unified action operational environment that accurately represent and simulate operational staff processes. Training tools and simulations must support individual and collective training in both garrison and deployed environments. Training tools and simulations must be hosted on the Mission Command system.

(HD-7) Utilizing Social Networking to Support Military Processes - The Future Force requires the capability to capitalize on all known means of networking to support instruction, training and basic communication between Soldiers. This includes the ability to adjust to and adopt appropriate emerging tools such as social networking. It also includes the ability to utilize digital technology's ability to share information and augment traditional methods of training and education. The Future Force must be proactive in both developing and exploiting technology to enhance military performance in full spectrum operations.

(T-8) Tailorable Simulations through Gaming Applications - The Future Force requires scalable, adaptable, and flexible gaming simulation technologies that replicate the COE and enhance training effectiveness. Rapid scenario and exercise generation tools are needed to increase timeliness, availability, and instructional outcomes of scenarios that replicate operational events to support training, education, and mission rehearsal. Rapid, user-friendly authoring tools will reduce development costs, time, and permit Soldiers and units in the field to create effective learning scenarios at the point of need.

(MC-8) Running Estimates - The Future Force requires the capability to continuously gather, track, and extrapolate information to support running estimates and tactical decision-making while developing the situation in a unified action operational environment to maintain and exploit the initiative during FSO.

(P-8) Enhanced Protection - Platform - The Future Force requires platforms with an occupant centric survivability scheme which uses a holistic approach across the entire vehicle in regards to weight, protection levels, and mobility. Due to the full spectrum of operational environments our mounted Soldiers encounter, the scalable protection layers should focus on defeating a wide range of threats while maintaining or enhancing our freedom of action. Future platforms may be enhanced with improved "active protection capabilities" which will defeat the threat prior to impact. The goal is to reduce the overall platform weight across each mission role.

(HD-8) Improve Foreign Language and Cultural Awareness - The Future Force requires the capability to develop Soldiers who are culturally informed and, to the degree practicable, conversant in local languages. To achieve this capability the Army must employ every applicable means to prepare Soldiers for the regions where they will operate. The Army must invest the time necessary to educate and provide cultural experience to an appropriate number of individuals who are regionally oriented, culturally informed, and capable of communication with foreign personnel.

(T-9) Innovative Learning Models, Strategies, and Tools - The Future Force requires greater knowledge of skill retention, learning science, and neuroscience applications to create innovative, adaptable, tailorable and flexible learning models, methodologies/strategies, and tools that result in more effective and efficient training, leader development, and education in institutions, at home-station and while deployed. Enhanced pedagogical methods are needed to inculcate critical FSO competencies (negotiation, influence, team building, adaptability, critical thinking, etc.) at appropriate levels across the career span.

(MC-9) Execute Network Operations - The Future Force requires the capability to allocate network resources in accordance with the commander's priorities to ensure network-enabled mission command in all conditions. The Future Force requires the capability to continuously gather, track, and extrapolate information to support running estimates and tactical decision-making while developing the situation in a unified action operational environment to maintain and exploit the initiative during FSO.

(T-10) Knowledge Management for the Learning Environment Development, Storage, and Distributed Access - The Future Force requires integrating knowledge management tools, techniques, technologies, and infrastructure to support an accessible, responsive, and adaptive 24/7 learning environment that is available world-wide at the point of need. Enhanced knowledge management and networking capabilities must enable the rapid development or adaptation, storage, delivery, and access to individual and collective training and education information and/or products (e.g., generation tools, training and learning management tools, knowledge banks, communities of practice, and collaborative learning). Networks and cloud-based infrastructure must support worldwide, secure, wireless delivery of learning products on platforms that range from fixed computers and simulation centers to mobile platforms. Capabilities are also required to establish protocols/standards, validate content, and provide for the assessment and effectiveness of products.

(MC-10) Airspace Control in Unified Action - The Future Force requires the capability to employ joint, multi-national, and civil airspace control capabilities for the planning and integration of airspace user requirements in joint operations and unified action to enable unity of effort in FSO.

(P-10) Enhanced Protection - Soldier - The Future Force requires enhanced scalable protection for both the mounted and dismounted soldiers (head, neck, body, and

extremities) from a full range of threats ranging from small arms, blast, and fragmentation. Enhancements should reduce weight while maintaining the same level of protection or have improved protection to defeat a larger threat as the current capability.

(MMvr-G-2) Unmanned Systems - Movement and Maneuver - The Future Force requires unmanned systems to support assured mobility; freedom of maneuver; reconnaissance and surveillance; manned-unmanned teaming; and reducing Soldier loads.

(MMvr-A-1) Collect/Develop Actionable Combat Information - (a) The Aviation Future Force requires the capability to conduct aerial armed reconnaissance during joint and combined arms air-ground operations to produce actionable combat information to update the air-ground common operational picture.

(b) The Aviation Future Force requires the capability to observe geographic areas, facilities, and mobile forces systematically with the ability to observe specific named areas of interest or target areas of interest (NAIs/TAIs). This capability is required throughout a Joint area of operations. The ability for continuous observation, wide area search, the ability to cue other collection capabilities, emitter mapping, warning of chemical, biological, radiological, nuclear, and high yield explosive (CBRNE) hazards, meteorological survey, the ability to detect tactical trends and patterns, and the ability to provide support to Intelligence, Surveillance and Reconnaissance (ISR) operations is also required.

(c) The Aviation Future Force requires the capability to exercise control of unmanned aircraft during manned-unmanned (MUM) teaming operations. Unmanned aircraft must have sufficient autonomy and crew or team decision aids to provide for extended range, resolution, and protection for manned platforms and to improve the persistence of the MUM team when conducting reconnaissance and surveillance operations in support of air-ground operations.

(d) The Aviation Future Force requires the capability to perform target acquisition and combat identification at, or beyond, the tactically preferred weapon during Joint and combined arms air-ground operations in order to overmatch the threat while avoiding fratricide or collateral damage.

(PE-S-5) Enhanced Energy Agility, Endurance, Conservation and Efficiency - The Future Force requires significant increases in energy agility and endurance for soldier, platform and basecamp use cases. This challenge demands integration of lightweight concepts, compact, high density energy supply systems (storage, conversion, delivery) and intelligent energy/power management, in order to double existing endurance (un-resupplied time and distance) for dismounted, mounted and stationary mission profiles and to provide access to currently unavailable terrain. The Future Force also requires sufficient capability to generate, manage, store and share electrical power for ground and aerial platforms underway (on-board systems) and at halt (networked with other systems), while minimizing signature and reducing fuel consumption and with minimal increase in size, weight, operating or maintenance effort.

(Int-1) **Holistic Human and Societal Assessment** - The Future Force requires the capability to integrate and assess human terrain information (cultural, psychological, and social) and political, military, economic, social, infrastructure, information, physical environment and time (PMESII+PT) variables, contributing to a more holistic assessment of the operational environment. This requirement includes the need to determine source credibility during screening operations and vetting of sources and the ability to determine deception during interrogation and questioning operations under field conditions

(F-1) **Air Defense** - The Future Force requires the capability to intercept in flight threat rockets, artillery, mortars, ballistic and cruise missiles, manned and unmanned aircraft in full spectrum operations in order to prevent surveillance, targeting, and attacks on friendly forces, population centers, and critical infrastructure.

(T-11) **Embedded Training** - The Future Force requires comprehensive, individual through collective, embedded combined arms training, to include mission command, mounted, and dismounted operational tasks. Embedded training must portray realistic battlefield effects (e.g., visual and aural cues) to enhance situational awareness during training events. ET must also have the ability to participate in the Army Integrated Training Environment (Army ITE).

(MC-11) **Cyber / Electromagnetic Capabilities** - The Future Force requires the capability to gain and maintain the cyber and electromagnetic advantage and deny same to adversaries to seize, retain, and exploit the initiative across the physical warfighting domains in a unified action operational environment.

(P-11) **Improved Route Clearance Capabilities** - The Future Force requires the ability to improve threat detection capabilities to support planning and response during tactical operations. Enable Soldiers conducting area/route clearance to avoid kill. Area/route clearance missions require the Soldiers to detect, mark and neutralize the explosive hazard.

(MMvr-G-3) **Scalable Munitions** - Future Army maneuver forces require precision, volume fire, and scalable (nonlethal to lethal) munitions, interoperable between joint and Army air platforms, to destroy or neutralize threat forces to support ground maneuver forces.

(MMvr-A-2) **Enable Assured Mobility and Vertical Maneuver** - (a) The Aviation Future Force requires the capability to tactically transport (dismounted vertical maneuver/air assault) combat Soldiers and associated equipment from land or sea bases, to austere or unprepared LZs in order to rapidly project combined arms forces. This includes precision troop insertion/extraction for long-range surveillance detachments, quick reaction forces, artillery raids and Combat Observation Lasing Teams.

(b) The Aviation Future Force requires the capability to transport cargo (personnel and supplies) to forward battlefield locations, with rapid loading and unloading, that require

minimum manpower or no off-board Material Handling Equipment (MHE) in order to sustain and maintain operations, division level and below (intratheater).

(c) The Aviation Future Force requires the capability to conduct rapid movement of emergency, planned, or critical logistics support that enables precise delivery of supplies and repair parts to forward battlefield locations, medical evacuation operations and relief operations.

(Int-2) Force Design - The Future Force design structure requires the capability to provide sufficient capacity and agility to effectively operate in future operational environments (OE). This requirement includes mobile devices which include intelligence-related applications and secure communications capability.

(F-2) Dismounted Target Acquisition Capability - The Future Force requires a lightweight dismounted target acquisition capability that integrates air and ground systems to facilitate precision fires.

(T-12) Cultural Awareness (Building Culture-General and Region-Specific Knowledge and Skills for the COE) - The Future Force requires the ability to understand, communicate, and coordinate effectively across diverse groups of people in a variety of cultures. Increased understanding of cross-cultural capability, associated learning objectives/measures, and sequencing of cross-cultural competency development is needed to create innovative, adaptable, tailorable, and flexible learning models, methodologies/strategies, and tools for Soldiers, civilians, and leaders to develop and sustain appropriate language and cultural competencies (region-specific and culture general) that enhance performance in complex FSO environments.

(MC-12) Alternative to GPS for Location and Navigation in Complex Environments - The Future Force requires an alternative means of determining geolocations of friendly, enemy, and non-combatant personnel in all terrain environments (including subterranean).

(P-12) Hemispherical Protection - The Future Force requires systems that provide enhanced hemispherical protection of fixed, semi-mobile/mobile forces; battlefield casualty extraction/transport; security operations.

(MMvr-G-4) UGV Autonomous Movement - The Future Force UGVs will need autonomous movement with tactical behaviors to support operations in varying terrain, weather, and battlefield conditions. They will support mounted and dismounted forces conducting full spectrum operations and must be capable of following or moving independently of mounted/dismounted Soldiers across rolling, open, constrictive, and complex terrain.

(F-3) Scalable Effects - Future Army forces require indirect fires capabilities in full-spectrum operations that provide the desired effects proportional to the target and situation, to prevent fratricide, and to minimize collateral damage.

(T-13) Live Training Capability - The Future Force needs to rapidly develop and conduct up to brigade combat teams synchronized live fire that replicates the complexities of mission command systems/sensors, hybrid threats, and the Joint / Interagency / Intergovernmental / Multinational (JIIM) operational environment.

(MC-13) Inform and Influence Activities: Future Army forces at all echelons require the capability to effectively inform domestic and friendly foreign audiences and influence foreign friendly, neutral and adversary audiences and receive and measure feedback in a fully integrated and timely manner through the use of synchronized themes, messages and actions designed to support operations.

(MMvr-G-5) UGV Autonomous Tactical Behaviors - Future Force unmanned systems must be able to execute complex tactical behaviors with minimal required operator intervention during a mission. These systems must allow for greater standoff detection, and be able to conduct breaching, reconnaissance, and clearing operations. These systems must be maneuverable enough to operate in normally inaccessible areas.

(T-14) Mobile Learning Capabilities - The Future Force must be able to access learning content at the point of need, to include mobile internet devices using secure wireless applications and infrastructure. Soldiers and leaders must have access to well-designed learning content and information that is relevant to their learning need, is secure, and accessible across their careers.

(T-15) Learner Assessments / Performance Evaluations - Enable Soldiers, leaders, and units to conduct accurate assessments and career management as a basis for determining future training and education. The Future Force requires the ability to maintain rigorous performance standards through the assessment of individual and unit knowledge, skills, and abilities. Innovative, adaptable, tailorable, and flexible methodologies/strategies, and tools are needed to create, administer, and track feedback from reliable and valid assessment measures, often in the absence of instructors and actual equipment. Assessments must support individual diagnostics to tailor/adapt individualized instruction, provide verification of mastery, and track preparedness for career progression. Unit leaders must have visibility of performance measures to conduct unit assessments to support better training management and operational effectiveness.

(Int-7) ISR Synchronization - The Future Force requires synchronize ISR assets and processes at decisive points to satisfy CCIR and achieve operations-intelligence integration. The Future Force requires the ability to provide tools and automation to aid the synchronization and optimization of ISR resources.

(T-16) - Intelligent Agent Coach/Mentor - The Future Force requires artificially intelligent agents to coach and mentor Soldiers, guide them through learning events, provide performance feedback, diagnose learning gaps, and anticipate and seek out learning content tailored to the learner's needs. This personal learning associate or

coach augments live coaches/mentors and is continuously available to tailor pedagogical learning objectives to individual learning needs.

(T-17) Automated Training Management and After Action Reviews - The Future Force requires innovative methods, techniques, and automated unit training management tools to support rapid team building, and mission planning and rehearsal to assure mission-tailored units achieve the level of readiness needed for rapid deployment. Unit training management tools must optimize warfighters' time spent participating in training, vice preparing for training or conducting administrative duties. Automated data collection, analysis and presentations for after action reviews (AAR) for live, virtual, constructive training require automated AAR development which is driven by training objectives and a full understanding of tasks, conditions and standards. Improved data collection and AAR development through increased artificial intelligence will reduce time and staff required to assemble AARs. AARs must also have the ability to participate in the Army Integrated Training Environment (Army ITE).

(S-12) Anticipatory Sustainment and Improved Distribution - The Future Force needs improved intelligent anticipatory tools and capabilities to manage, track, redirect, account for, and distribute supplies in an automated manner to provide improved asset visibility and understand demand. The Future Force requires the ability to provide logistics support for forced entry, early entry, and non-contiguous operations.

(Int-8) Analytical Rigor - The Future Force requires the capability to support rigorous all-source and single-source analysis through the use of processes, technologies, and techniques. This requirement includes sufficient capability to analyze and assess shifting loyalties and changing environments, and to continually reassess the efficacy of the intelligence process.

(T-18) Models and Simulations for Training Effectiveness Analysis - The Future Force requires the development of models, simulations or other tools that: (a) evaluate the effectiveness and efficiency of existing training programs and products; (b) predict impacts of proposed training products and programs and; (c) enable comparison of ROI (time, manpower, money) across training methodologies and strategies.

(S-13) Improved Inter-Modal Platforms, Technologies, and Techniques - The Future Force requires faster, more efficient and effective deployment and sustainment of forces via improved inter-modal platforms, technologies and techniques. Enablers should include air and ground delivery systems as well as packing, tracking, temperature control and reporting capabilities.

(S-18) Base Camps - Future Army forces require the capability to plan, design, construct, operate, transfer, and close base camps in a joint, international, and multinational environment to provide safe, secure, and largely self-sustaining base camps to support full-spectrum operations.

Tier 3 - FY 12 Warfighter Outcomes – Essential Capabilities

(P-7) Predict Enemy Capabilities, Actions, Effects or Hostile Intent - The Future Force Soldier at the small unit level needs enhanced situational awareness and the capability to continually assess threat capabilities, actions, effects, and/or hostile intent in order to understand battlefield dynamics and protect personnel, assets, and information.

(P-9) Identify, Prevent and Mitigate the Use of CBRN (CWA/NTA/ Selected TIM) Agent Dispersal Modes (Sprayers, CBRN-Filled IEDs, Bomblets, etc) at Standoff Distances - The Future Force requires the ability to detect, identify, and neutralize CBRN (CWA/NTA/ Selected TIM) material dispersal modes prior to dispersal, or areas contaminated previously, to protect personnel, equipment, terrain, and facilities from the effects of CBRN contamination (CWA/NTA/ Selected TIM).

(S-6) Explosive Ordnance Disposal - Future Army forces require the capability to dispose of conventional and unconventional explosive threats utilizing advanced technology in complex environments, over extended distances, and for extended periods of time.

(MMvr-A-3) Destroy/Neutralize Enemy Targets - (a) The Aviation Future Force requires a suite of air-ground weapons that provide lethal overmatch against the anticipated target set in a C3D2 or countermeasures environment, increased precision and range with scalable effects (lethal and non-lethal). Line of sight (LOS) and beyond line of sight (BLOS) targeting with both man-in-the-loop precision terminal control after launch, as well as through the weather fire-and-forget engagement option is needed. The Aviation Future Force requires a common precision munition that is interoperable between both rotary wing and UAS platforms. Additional needs include the ability to conduct passive targeting, and to provide additional weapon flexibility (easy integration of additional weapon types and mixes).

(b) The Aviation Future Force requires the capability for direct access to Army and Joint fire delivery systems from external sources to provide extended range, networked, responsive precision or volume fires and the capability to provide and/or integrate close air support (CAS) on demand.

(c) The Aviation Future Force requires smaller, lighter and cheaper munitions to provide improved aircraft performance margin, range and endurance, increased stowed kills, and to permit employment of precision munitions in a greater percentage of engagements to reduce the potential for fratricide and collateral damage.

(d) The Aviation Future Force requires the capability to receive air threat warning, alerting and cueing information and to detect, correctly identify and defeat low slow flying UAS and rotary wing threats as a secondary mission during Joint and combined arms air-ground operations to provide lethal overmatch against threats and provide security to friendly forces.

(e) The Aviation Future Force requires the capability to provide accurate and timely Battle Damage Assessment (BDA).

(S-7) **Human Resources** - Future Army forces require the capability to accurately assess, predict, and fill manpower requirements, assess a Soldier's readiness to deploy, and account for the force to ensure commanders have the right Soldier, with the right skill sets, at the right time.

(P-13) **Warn Individuals** - The Future Force requires the ability to communicate standard and rapid warnings to designated recipients throughout the services and agencies regardless of communication means.

(MMvr-A-4) **Ensure Aircraft and Aircrew Survivability** – (a) The Aviation Future Force requires the capability to conduct worldwide operations in day/night/reduced visibility conditions due to adverse weather and environmental obscurants (blowing dust, snow, and debris). Pilots must be able to maintain situational awareness (SA) during terrain flight and low altitude maneuvers in order to avoid collision with adjacent obstacles or other aircraft.

(b) The Aviation Future Force requires the capability to operate against unpredictable threats and small arms fire, rocket propelled grenades (RPGs), man portable air defense system (MANPADS), directed energy weapons, anti-helicopter mines, and natural or emplaced flight path obstacles.

(c) The Aviation Future Force requires the capability to provide integrated, modular, mission tailorable Aviation Life Support Equipment (ALSE) and protective ensemble with enhancements that enable aviation Soldiers and crewmembers endurance in weather conditions.

(S-8) **Reliability, Prognostics, and Diagnostics** – The Future Force requires significantly improved reliability for all air, ground, water, and C4ISR systems to increase availability, enhance soldier protection, reduce logistic support, and reduce life cycle costs. The Future Force requires embedded prognostics and improved diagnostics to predict, isolate and locate system degradation and failures.

(F-4) **Automatic Target Recognition** - The Future Force requires the capability to achieve Automatic Non-cooperative Target Recognition for immediate response to critical targets.

(P-14) **CBRN (CWA, NTA and Selected TIM) Alarm** - The Future Force requires the ability to: (a) Detect the presence of a CBRN (CWA/NTA/select TIM) hazard to warn; (b) Determine when the threat is no longer a hazard in order to reduce the protective posture.

(MMvr-G-6) **Rapidly Cross Wet and Dry Gaps** - The Future Force requires the ability to rapidly bridge small gaps delivered by manned and unmanned systems.

(MMvr-A-5) **Sustain and Maintain Aviation Operations** - (a) The Aviation Future Force requires the capability to provide a fully deployable Aviation sustainment maintenance organization, which can be either land based or sea based.

(b) The Aviation Future Force requires the capability to maintain a high operational readiness rate, with minimal demands on quality and quantity of logistics manpower and compatible with the common logistics environment.

(c) The Aviation Future Force requires the capability to establish and automate a condition based maintenance process.

(d) The Aviation Future Force requires the capability to minimize aircraft turn-around time for refueling and rearming in order to provide timely and responsive support on a greatly expanded battlefield.

(S-9) Austere A/SPOD Assessment & Enhancement - The Future Force requires the ability to rapidly assess, establish and upgrade multiple A/SPODs to support operational movement and maneuver.

(Int-5) Intelligence Support to Cyber Operations - Future Army forces require the capability to provide intelligence support to cyber operations during full-spectrum operations, to provide the commander intelligence to support targeting (fires) and decision-making.

(F-5) Reduced Weight Munitions - The Future Force requires the ability to achieve equal or greater lethal effects with reduced weight munitions (Small arms through NLOS).

(CIED-P-15) Visual and Virtual Obstacle Marking System - The Future Force requires the ability to digitally and physically mark obstacles and hazard areas (IED, mines, CBRN-CWN/NTA/Selected TIM hazards) in all weather conditions to inform personnel and the common operational picture.

(MMvr-G-7) Standoff Sense Through Walls - The future operational environment requires that platforms have the capability to detect and track enemy elements in buildings and (subterranean infrastructure) in the urban environment

(MMvr-A-6) Enable Aviation Battle Command - The Aviation Future Force requires the capability to access the aviation battle command capabilities essential for all aviation platforms; to include NLOS/BLOS data, voice, imagery, video, UAS control, AC2, and Fires.

(S-10) Unmanned Systems - Support - The Future Force requires unmanned systems to support sustainment tasks, functions, and missions of: supply, deploy, employ, re-deploy, reset, distribution, and services, including unmanned air and ground delivery systems from home station to deployed locations. The Future Force requires unmanned systems that perform tele-medicine/surgery.

(Int-6) Intelligence Enterprise - The Future Force requires the capability to leverage the Intelligence Enterprise and access to the all-source data and knowledge bases, throughout the DoD community, for intelligence support operations.

(F-6) **Target Discriminating Munitions** - The Future Force requires the capability for multifunctional munitions that can discriminate target types and apply the appropriate effects.

(P-16) **Identify and Mitigate Directed Energy (Blinding Laser and RF) Threats** - Future Force Soldiers require active and passive capabilities to detect and defend against directed energy (blinding laser/RF) threats.

(MMvr-G-8) **Specialized Urban Breaching** - The Future Force requires the ability to breach entry points into urban infrastructure and disable assets from stand-off locations.

(S-11) **Provide Water** - The Future Force requires the ability to purify water from all sources, produce potable water from atmosphere and/or exhaust to minimize/eliminate its transportation and storage, and provide rapid and field expedient testing capability for Soldiers to ensure no contaminants or biological growths are present.

(F-7) **Networked Precision Fires and Effects** - Future Force commanders require the ability to apply full-dimension effects throughout the battlespace. Networked Fires enable precise application of effects against decisive points, centers of gravity and key nodes.

(P-17) **Identify and Mitigate Subterranean Threats** - The Future Force requires the capability to detect subterranean passageways to prevent enemy or detainee activity below the surface of the Earth.

(MMvr-G-9) **Rapid Construction and Repair of Combat Routes and Trails** - The Future Force requires the ability to rapidly construct and clear combat routes to aid small unit mobility and maneuver without emitting a signature (audible, visual).

(F-8) **Passive Marking and Designating** - The Future Force requires LOS/BLOS/NLOS passive marking and designation systems to provide responsive precision network fires and support combat identification.

(P-18) **Environmentally Friendly Decontaminants** - The Future Force requires standard decontaminants that mitigate the effects of CBRN hazards and do not adversely impact the environment, personnel or equipment.

(MMvr-G-10) **Threat Detect at Extended Ranges** - Future Army forces require the capability to detect threats at extended ranges and with sufficient target location accuracy to permit engagements, and provide early warning to friendly forces and populations.

(Int-9) **Weapons Technical Intelligence (WTI)** - The Future Force requires the capability to apply sufficient weapons technical intelligence (WTI) capability to enable data and material discovery. More specifically, forces require the ability to reliably

access and share battlefield data and/or materials, and disseminate exploited information/intelligence.

(P-19) **CBRN (CWA/NTA/Selected TIM) Filters and Subcomponent Filtration Systems** - The Future Force needs improved CBRN (CWA/NTA/ Selected TIM) filters and subcomponent filtration systems that are more effective against TIM & NTAs, and are easier to maintain.

(MMvr-G-11) **Remotely Fired Munitions** - Future Army maneuver forces require the capability to employ remotely fired munitions to increase survivability and lethality during operations.

(S-14) **Process and Render Safe Contaminated Remains** - The Future Force requires the ability to safely conduct mortuary processes on CBRN contaminated remains and render them safe for transport and final disposition.

(Int-10) **Document and Media Exploitation** - The Future Force requires the capability to process and exploit captured enemy documents and media to rapidly assess the battlefield situation, direct forces, develop high-value targeting packages and enable mission success.

(F-9) **Lethality Overmatch Against Advanced Armors and Hard Targets** - The Future Force requires advanced special multipurpose munitions for use against advanced armors and hardened above/below ground targets that were previously considered impenetrable.

(P-20) **CBRN Exposure Monitoring** - The Future Force Soldier requires the capability to monitor the effectiveness of individual and small unit protection ensembles which will warn the force when and where failures from CBRN threats (CWA, NTA and Selected TIM) are going to occur. This feature needs to be integrated into the protective ensemble it is monitoring.

(S-15) **Maintainability – Tool Free Maintenance** - The Future Force needs technologies and designs which allow minimal-tool maintenance.

(Int-11) **Weather** - The Future Force requires the capability to continuously detect and forecast rapidly changing weather conditions in all environments and with sufficient capability to provide wide-area, weather observation and processing. This capability includes a layered network of systems to enable persistent monitoring and forecasting of changing weather conditions.

(F-10) **Fires for Forcible Entry** - The Future Force requires highly mobile ground-based fires for forcible entry operations.

(P-21) **Soldier Hearing Protection** - The Future Force requires the ability to provide protection from adverse effects on Soldier hearing without impacting auditory situational awareness.

(S-16) **Adaptable Facilities Deployed and at Home Station** - Provide dynamically adaptable infrastructure at home station and for deployed force. Provide the capability to rapidly and inexpensively construct permanent and expeditionary facilities which can be configured and reconfigured to adapt to changing mission, equipment, and personnel requirements.

(Int-12) **Biometrics and Forensics Enabled Intelligence** - The Future Force requires the capability to provide the Biometric Enabled Intelligence, Forensic Enabled Intelligence, and contextual analysis on biometric subjects, associations and patterns. This includes the ability to positively detect, identify, and track, non-cooperatively with precision, high value individuals at stand-off distances in complex environments, and to retrieve/match personnel identification data from Joint, Interagency, Intergovernmental, and Multinational (JIIM) repositories.

(F11) **Precision-to-Conventional** - Future Army forces require fires with a wide range of area to precision capabilities to provide effective and efficient effects.

(P-22) **Unmanned Systems - Force Protection Integration** - The Future Force requires the ability to integrate unmanned systems into force protection surveillance and response systems. This will increase the operational capability of individual Soldiers by allowing them to complete other missions or permit additional rest cycles in the mission profile.

(S-17) **Sustainable Joint/ARFORGEN Base Operations** - Provide capability to deploy, redeploy, and reset base operations by providing flexible and responsive services synchronized to support Soldiers, Families, and civilians throughout the ARFORGEN process.

(F-12) **Unmanned Systems – Fires** - The Future Force requires unmanned systems to assist in planning, development, and execution of lethal/non-lethal engagements, direct/indirect fires, and target identification.

(P-23) **Soldier Signature Reduction** - The Future Force requires the capability to reduce the signature of Soldiers and their equipment on the battlefield.

(F-13) **Cluster Munitions Alternatives** - The Future Force requires a DPICM alternative capability that complies with DoD Cluster Munitions Policy

(P-24) **Model Hazard Effects of CBRN** - The Future Force requires methodology to model (predict) and provide common representation of Chemical, Biological, Radiological, or Nuclear (CBRN) hazard areas and effects resulting from CBRN

weapons and Toxic Industrial Materials (TIM), and display results, on the common operating picture.

(S-19) Retard Decomposition, Improve Transportation, and Obtain Positive ID of Remains - The Future Force requires the ability to retard decomposition prior to and during mortuary processing and transportation to support positive identification of remains within full spectrum operations.

(F-14) Body Armor Lethality Overmatch - Future Force Soldiers require small arms multipurpose munitions that will penetrate advanced body armor.

(P-25) Austere A/SPOD Protection and Security - The Future Force requires the ability to provide protection and security for airlift and sealift operations during ingress, egress, and offloading at multiple A/SPODs.

(F-15) Near Real Time BDA - The Future Force requires near real time BDA to enhance effectiveness and efficiency of fires.

(F-16) Obscurants and Illumination – The Future Force requires the capability to employ multispectral obscurants and illumination to limit enemy freedom of action and support combined arms operations.

Key:

<i>T</i>	<i>Training</i>
<i>MC</i>	<i>Mission Command</i>
<i>PE-S</i>	<i>Power & Energy (Sustainment)</i>
<i>CIED-P</i>	<i>Counter IED (Protection)</i>
<i>HD</i>	<i>Human Dimension</i>
<i>MMvr-G</i>	<i>Movement & Maneuver - Ground</i>
<i>MMvr-A</i>	<i>Movement & Maneuver - Air</i>
<i>P</i>	<i>Protection</i>
<i>S</i>	<i>Sustainment</i>
<i>Int</i>	<i>Intelligence</i>
<i>F</i>	<i>Fires</i>